1. Scope

The geographic scope of the CalFed "solution area" encompasses all of the Central Valley, San Pablo and San Francisco bays, and the near-shore Pacific ocean. Our evaluation of diversion effects on fish populations was confined to the legally defined Delta. Consequently, we did not incorporate into our evaluation the potential beneficial and adverse effects of actions outside the Delta. Fluctuations in ocean and bay conditions, salmon and striped bass harvest management, CalFed's Ecosystem Restoration and Water Quality programs that occur outside the delta, and actions associated with the Central Valley Project Improvement Act (CVPIA) are all likely to affect fish populations.

Restoration and recovery of these three species will depend on CalFed actions outside of the "problem identification area" that we have addressed. CalFed's actions must also address many issues of greater uncertainty than those we have addressed. Therefore, we are unable to assess the degree to which the effects of these delta-based scenarios contribute to overall restoration and recovery. A far more complex and time-consuming analysis would be necessary to integrate the Delta effects we identify, with the broader range of natural fluctuations and human activities that will determine recovery.

We have identified the principle mechanisms by which storage and conveyance will affect these species, when these species are in the Delta. We have assigned relative ranks to summarize our assessments of the balance of impacts and benefits for each scenario.

2 & 3.Professional Judgement and Uncertainty

Evaluations were based on the team's best professional judgement of the degree to which each relevant parameter affects each of the key species. The judgements considered empirical relationships between parameters and survival, where such relationships were available. Evaluations were based on operations modeling studies and qualitative assessments of the degree to which water operations, water management facilities, and biological factors affect the populations of each species.

The evaluations recognized the many sources of uncertainty that derive from the limitations of our scientific knowledge about the species and Bay-Delta ecosystem. From an analytical perspective, monthly averaged hydrology was the primary hydrologic parameter used in the analysis. The use of particle tracking model output, which is based on short time-steps, would help reduce this uncertainty. From a species perspective, for example, the benefits of shallow water habitat to Delta smelt are not yet well understood. With regard to striped bass, the continuation of historic relationships into the future is unclear due to the many changes in the system. For salmon, the sources of mortality in the Delta are poorly understood. The various sources of uncertainty were acknowledged and considered to the extent possible in the evaluation

4. Model Runs, 5. Storage, 6. Wet/Dry Years,7. VAMP

Evaluations are based on a single operations study for each scenario. There has been no attempt to minimize impacts or maximize benefits. The next phase of the teams efforts will be to optimize the alternatives. The specific CALFED operations studies used for each scenario were: Existing Conditions-558, NoAction-516, Common Programs-, Alternative 1 without storage-518, Alternative 1 with storage-609, Alternative 2 without storage-528, Alternative 2 with storage-532a, Alternative 3 without storage-595, and Alternative 3 with storage-567. These runs included meeting the flow requirements for the Vernalis Adaptive Management Plan (VAMP). Analyses were based on monthly flows at selected locations in the Delta averaged over all years and averaged over selected dry and critical years. No attempt was made to explore the full range of annual variability

Using the model runs above, each alternative was analyzed with no storage and with maximum storage. This range of storage represents the extremes of existing storage to an additional 6.2 MAF of new storage. Storage between these two extremes would have marked results of the outcome of these evaluations. There was no attempt to minimize impacts or maximize benefits by optimizing storage.

For each alternative, the model runs produced average monthly flows at locations throughout the Delta. Wet and dry year flow summaries were used in the evaluation of impacts of an alternative. In some cases , using average monthly flows and monthly summaries could minimize the actual impacts or benefits of an alternative. The team attempted to account for the model limitations in their evaluations.

8. Common Programs

The evaluation of the effects of the Common Programs posed particular challenges for this evaluation. For example, at the current programmatic level of development, the distribution of restored/rehabilitated wetland and riparian habitat has not been defined. Different distributions of habitat would benefit different species. However, even if the distribution were clearly defined, our current level of scientific knowledge limits the evaluation of the benefits that would accrue to each species.

There was a broad consensus among the team that the common programs will provide benefits to each of the evaluated species. The quantification of these benefits is, however, not possible at this time. Increasing the amount of habitat will almost certainly increase the survival of each of the evaluated species, but the magnitude of the increase can not be estimated.

9. Water Quality

Changes in point of diversion are expected to have large effects on a variety of water quality parameters in the delta. San Joaquin River water carries a significant load of agricultural chemicals, selenium, and other contaminants and nutrients. Sacramento River water generally carries lower loads and

carries different metals such as copper, mercury, cadmium and zinc. Delta water directly recieve a variety of agricultural chemicals (including herbicides), salts and organic carbon. Contaminant loads and concentrations vary seasonally, vary with hydrology, and can be expected to vary with different points of diversion and changes in operating criteria. The availability and effects of these chemicals on fish populations, and the food web that supports them, are unknown but potentially significant. Impacts may occur through direct toxicity, but are more likely through chronic effects or trophic disruptions. Synergisms of chronic effects with other factors such as disease or reduced growth that prolongs exposure to predators may also result in effects on fish populations. The Diversion Effects on Fisheries Team has not attempted to incorporate any of these factors into the estimations of fishery impacts. A team of appropriate experts should be formed to evaluate these factors and help the Diversion Effects on Fisheries Team to revise the present report.

10. Exotics

The Bay/Delta is dominated by non-native species. Some introduced species have substantially altered the functioning of ecosystems they have invaded and we have limited understanding of the new ecological relationships among species. New species will likely continue to arrive and disrupt the biological communities of the estuary in the future. All data and analyses, therefore, that rely on historical relationships may not predict the future but they are the only available basis for analysis. The almost certain arrival of new species in the future may alter the ability of the estuary to support these three species but the effects in changes in points of diversion are much less likely to be influenced by new introductions.

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